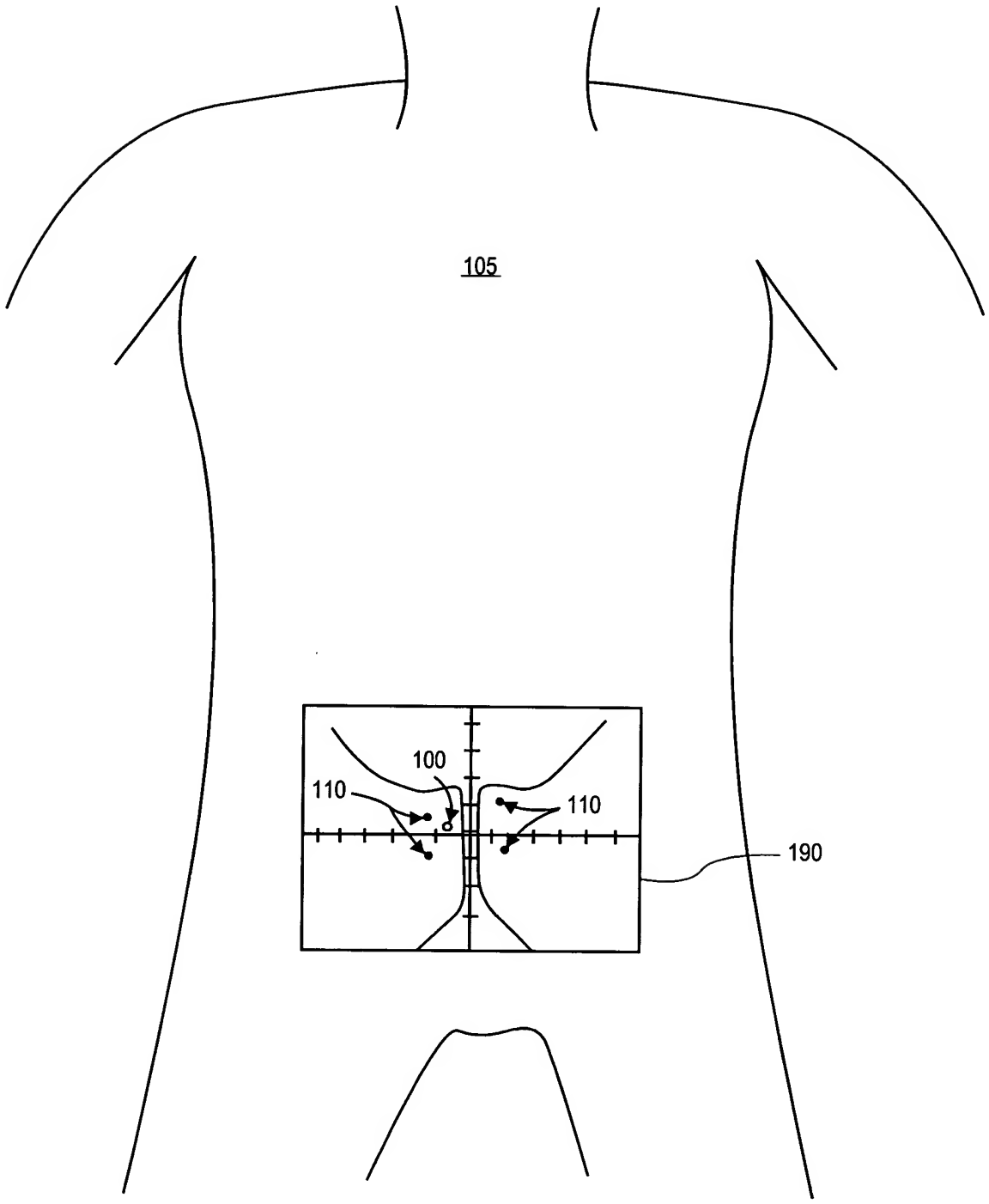

FIG. 1A

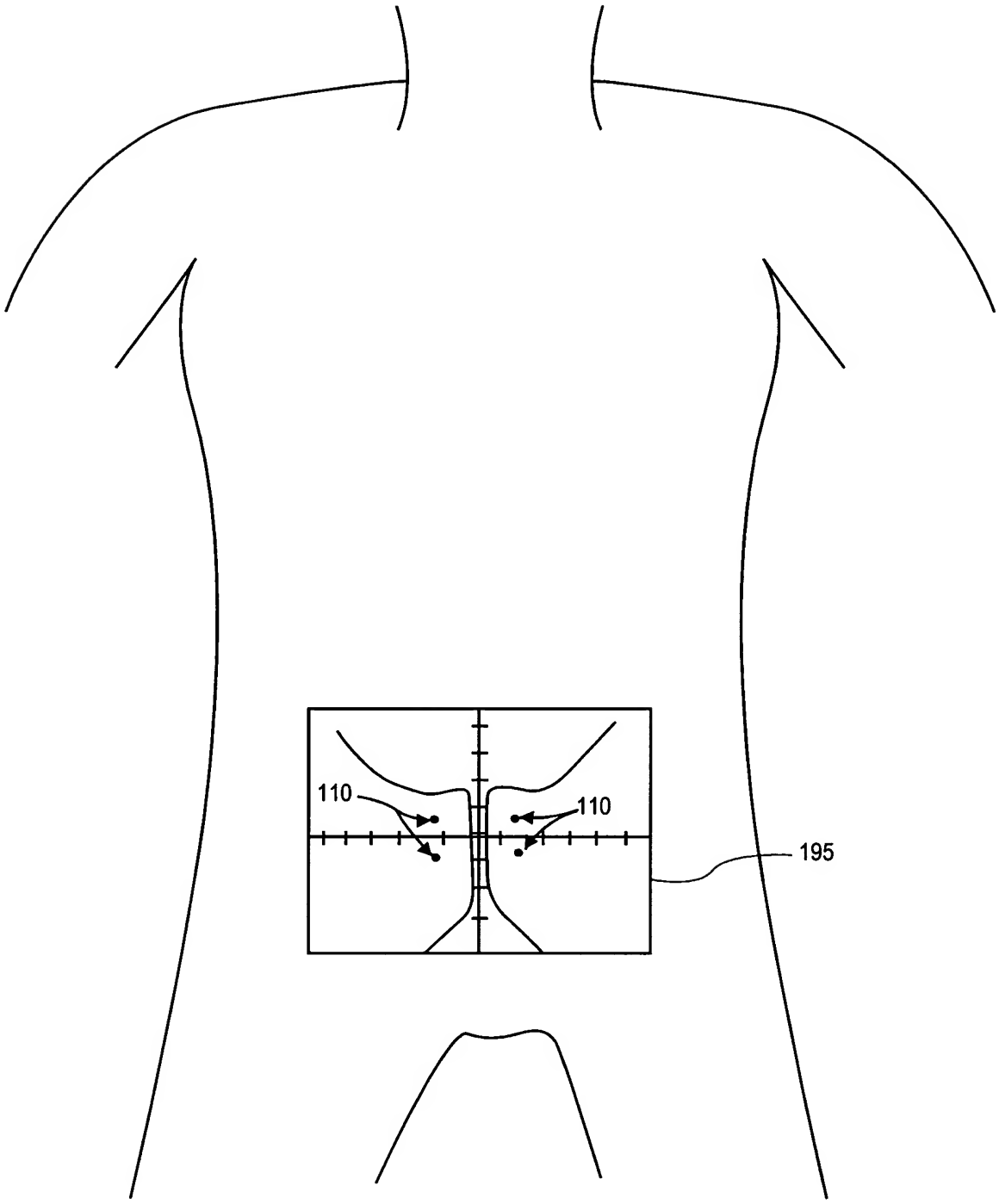

FIG. 1B

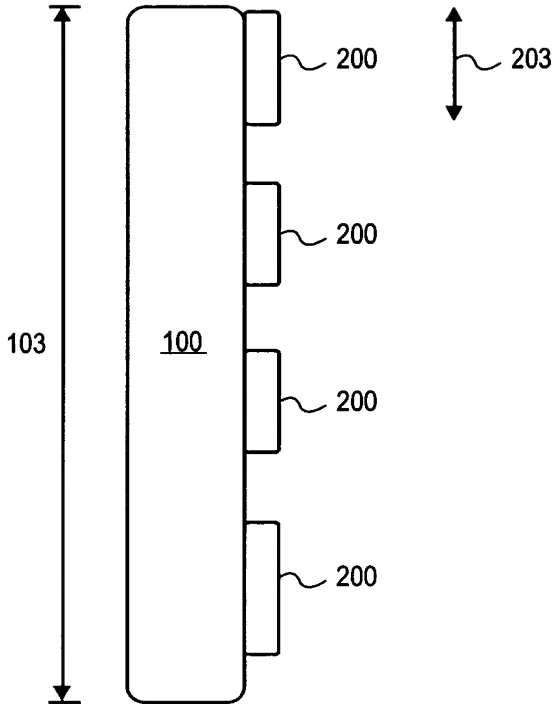

FIG. 2A

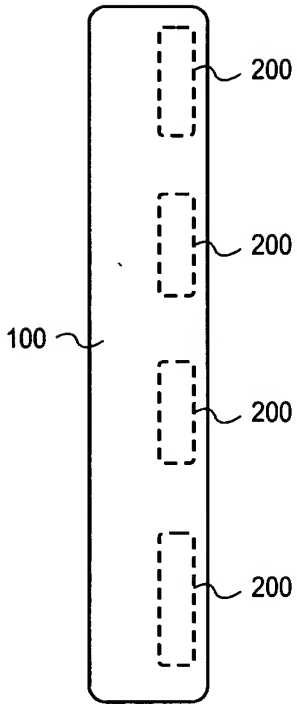

FIG. 2B

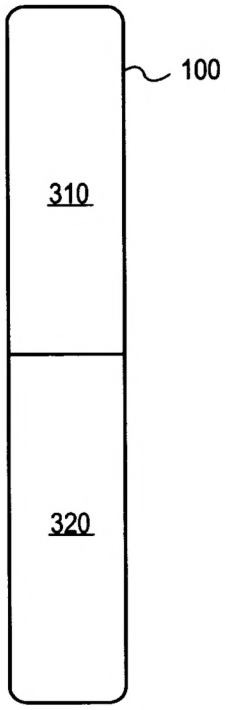

FIG. 3

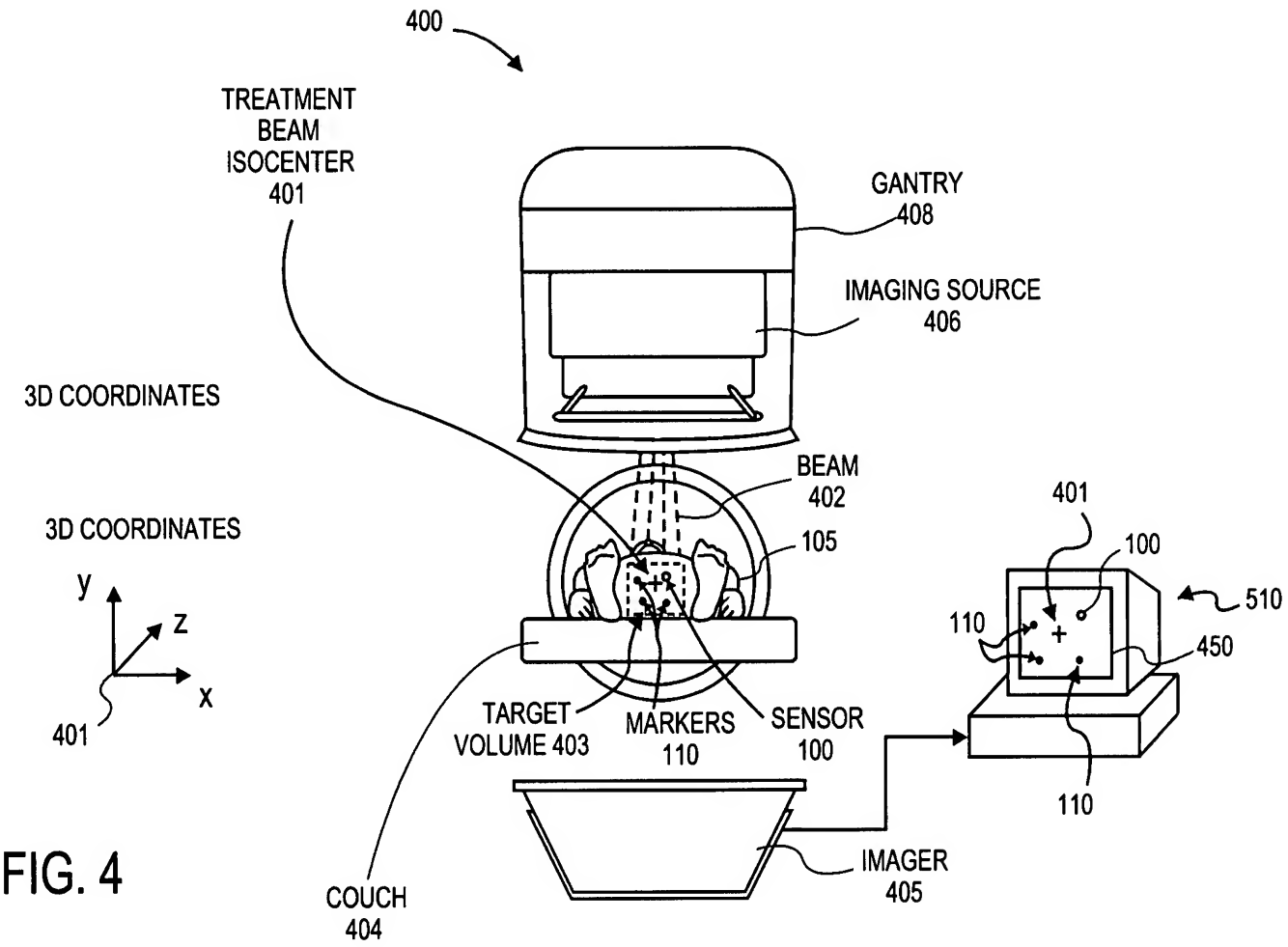
400
TREATMENT BEAM ISOCENTER 401
GANTRY 408
IMAGING SOURCE 406
3D COORDINATES
BEAM 402
3D COORDINATES
y
z
x
401
105
401
100
510
110
450
TARGET VOLUME 403
MARKERS 110
SENSOR 100
110
IMAGER 405
COUCH 404

FIG. 4

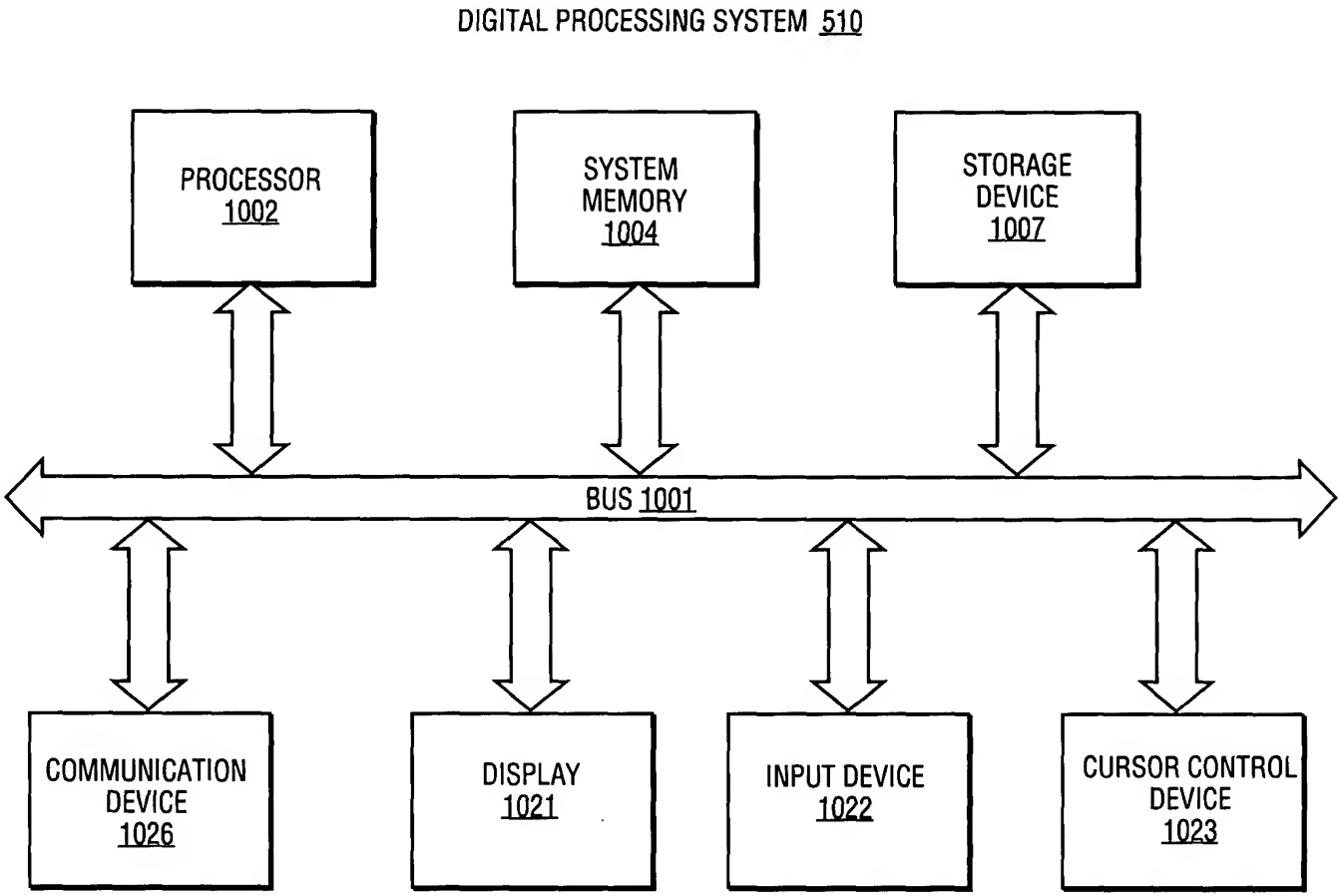
DIGITAL PROCESSING SYSTEM 510
PROCESSOR 1002
SYSTEM MEMORY 1004
STORAGE DEVICE 1007
BUS 1001
COMMUNICATION DEVICE 1026
DISPLAY 1021
INPUT DEVICE 1022
CURSOR CONTROL DEVICE 1023

FIG. 5

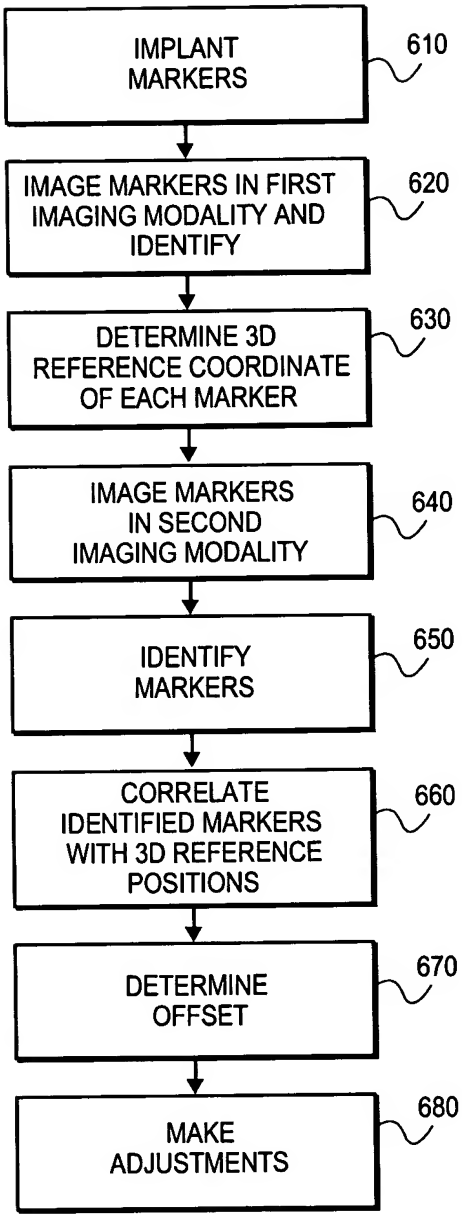
IMPLANT MARKERS
610
IMAGE MARKERS IN FIRST IMAGING MODALITY AND IDENTIFY
620
DETERMINE 3D REFERENCE COORDINATE OF EACH MARKER
630
IMAGE MARKERS IN SECOND IMAGING MODALITY
640
IDENTIFY MARKERS
650
CORRELATE IDENTIFIED MARKERS WITH 3D REFERENCE POSITIONS
660
DETERMINE OFFSET
670
MAKE ADJUSTMENTS
680

FIG. 6

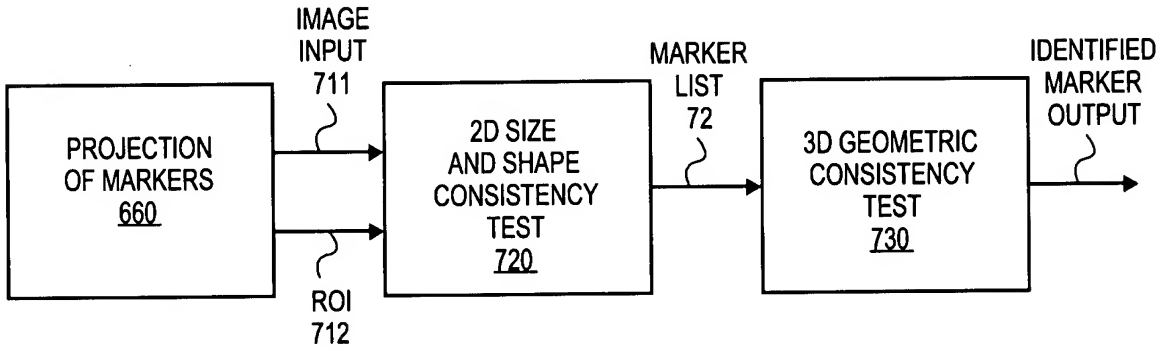
PROJECTION OF MARKERS 660
IMAGE INPUT 711
ROI 712
2D SIZE AND SHAPE CONSISTENCY TEST 720
MARKER LIST 72
3D GEOMETRIC CONSISTENCY TEST 730
IDENTIFIED MARKER OUTPUT

FIG. 7

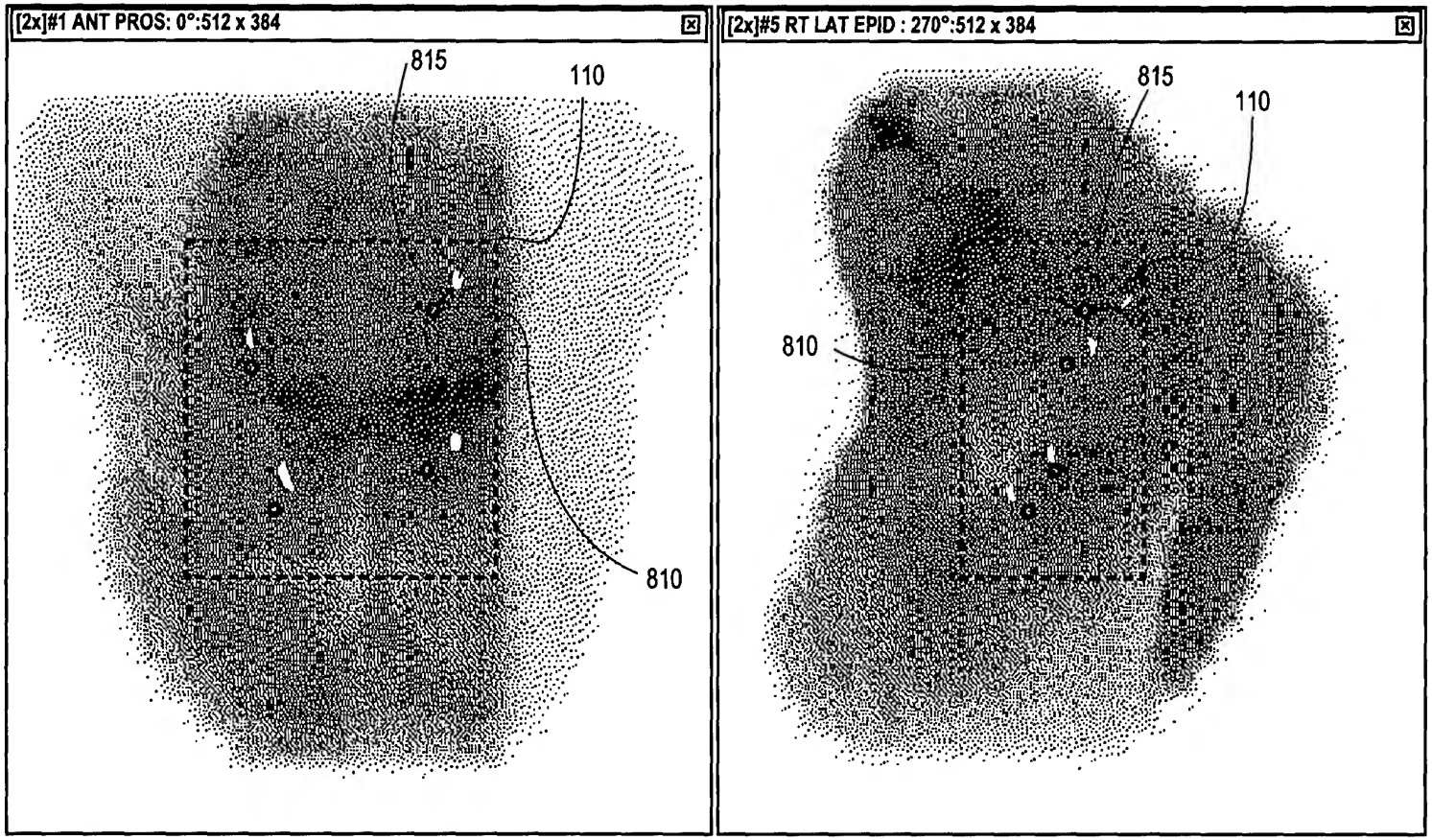
[2x]#1 ANT PROS: 0°:512 x 384
815
110
810
[2x]#5 RT LAT EPID : 270°:512 x 384
815
110
810

FIG. 8A

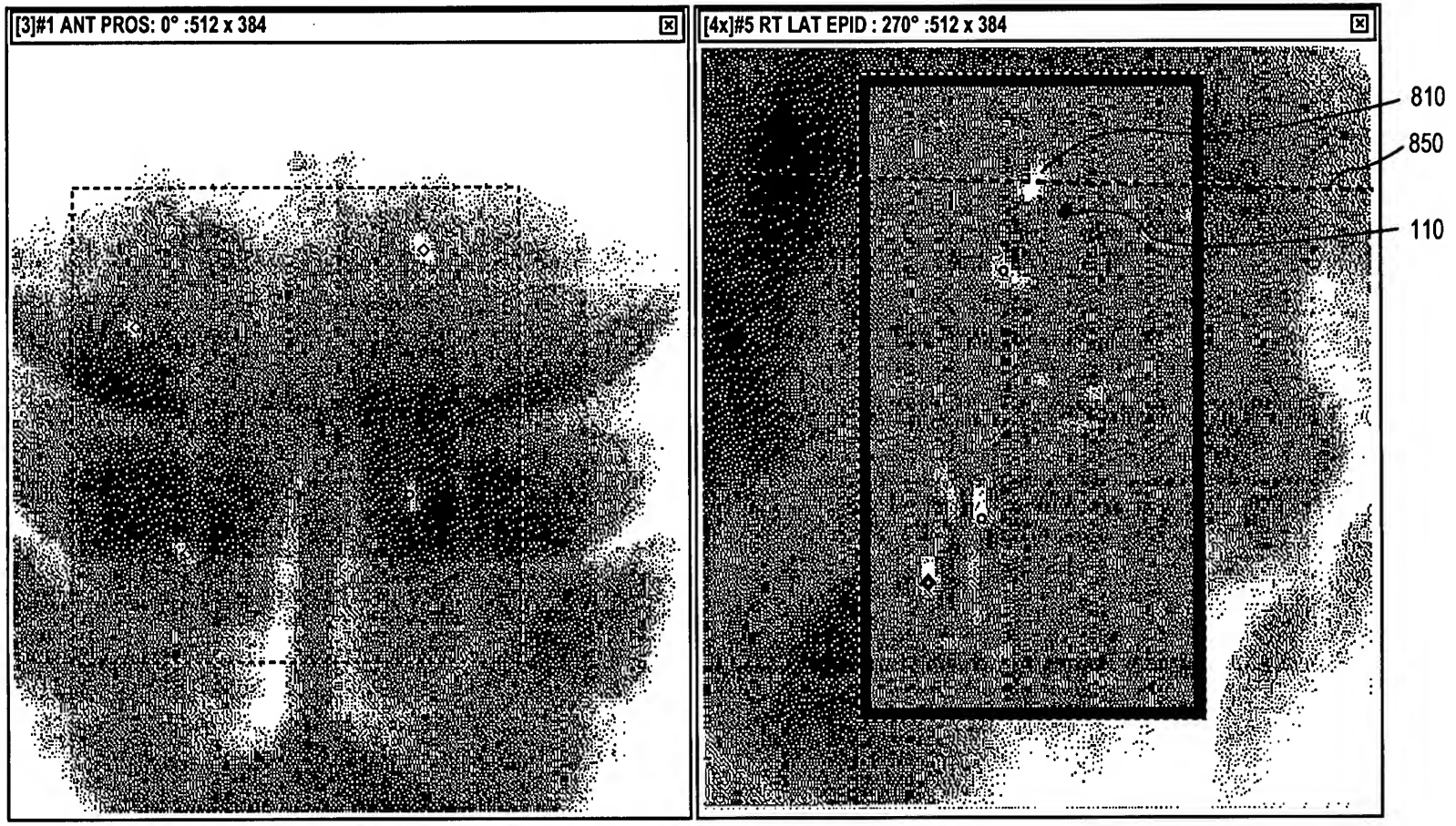

IMAGE A

IMAGE B

FIG. 8B

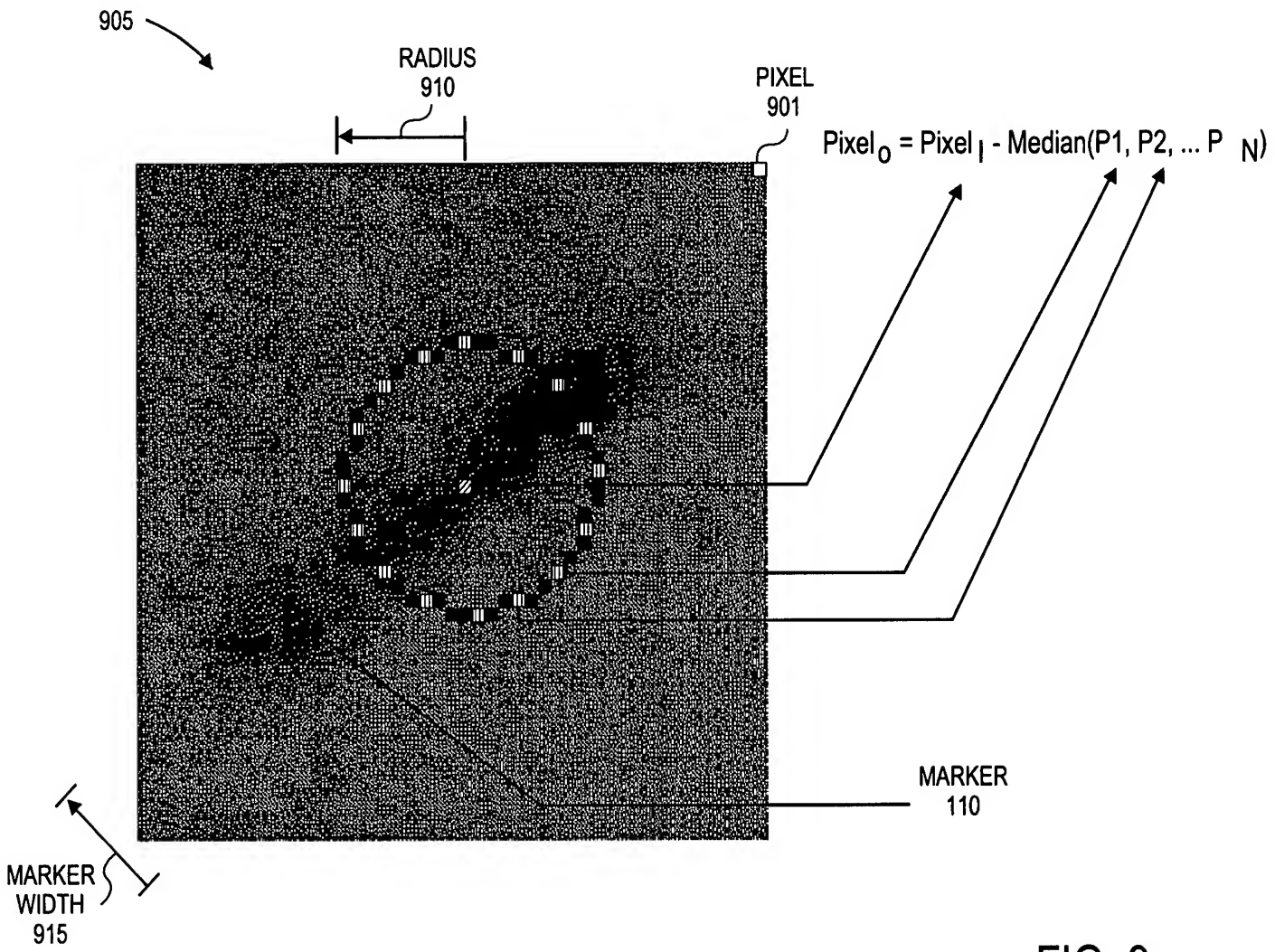
905
RADIUS
910
PIXEL
901
Pixel O = Pixel I - Median(P1, P2, ... P N)
MARKER
110
MARKER
WIDTH
915

FIG. 9

IMAGE REGION WITH SEED

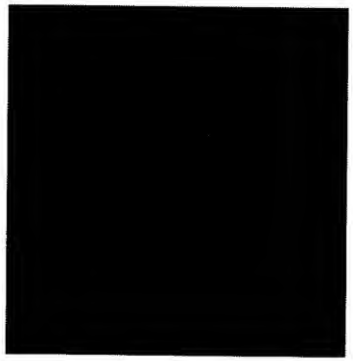

FIG. 10A

FIG. 11A

FIG. 12A

IMAGE REGION WITH NOISE

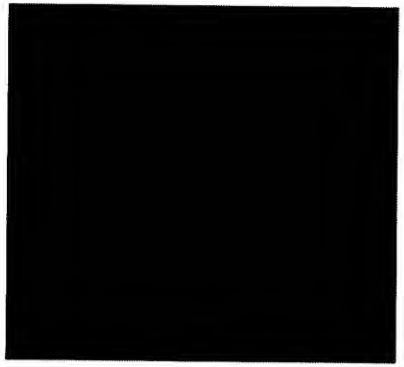

FIG. 10B

FIG. 11B

FIG. 12B

Rigid or deformable target 1310	Number of visible implanted markers 1320	Number of positioning images in each treatment session 1330	Adjustments that can be estimated 1340
Rigid	Three or more	Two or more from different angles suitable for triangulation	For each treatment field: patient position/orientation, MLC position/rotation
Deformable	Three or more	Two or more from different angles suitable for triangulation	For each treatment field: patient position/orientation, MLC position/rotation, MLC shape; the accuracy of MLC shape calculation depends on the number of markers and the spread of them in the target volume
Rigid	Three or more	One - (preferably from the direction that markers are most visible)	For all treatment fields: patients position/orientation; MLC position/rotation
Deformable	Three or more	One - from the same angle as the treatment field	For that treatment field: patient position/orientation; MLC position/rotation, MLC shape
Deformable	Two	One - from the same angle as the treatment field	For all treatment fields: patients position/orientation; MLC position/rotation
Rigid	One	One - from the same angle as the treatment field	For that treatment field: patient/MLC position

FIG. 13

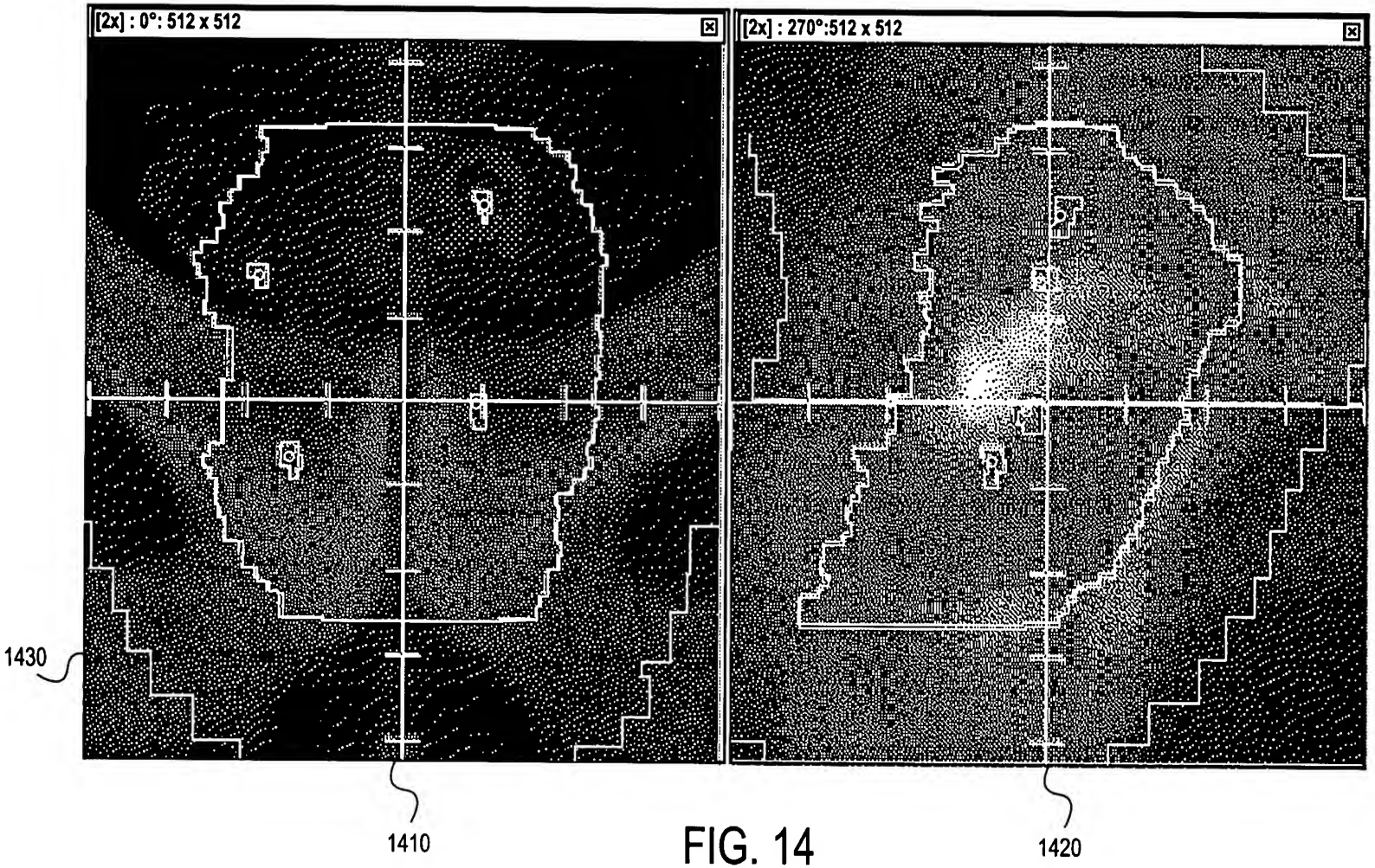

FIG. 14

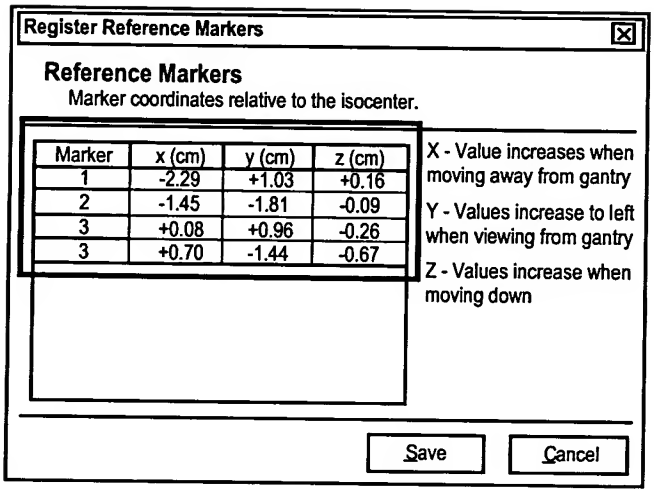
Register Reference Markers
Reference Markers
Marker coordinates relative to the isocenter.
Marker x (cm) y (cm) z (cm)
1 -2.29 +1.03 +0.16
2 -1.45 -1.81 -0.09
3 +0.08 +0.96 -0.26
3 +0.70 -1.44 -0.67
X - Value increases when moving away from gantry
Y - Values increase to left when viewing from gantry
Z - Values increase when moving down
Save
Cancel

FIG. 15